

Services

Services Overview ■ Services in the PlayPlus architecture handle data operations, business logic, and external API communication. They provide a clean abstraction layer between your application and external data sources, ensuring consistent data management across your application. Key Characteristics ■ Data Layer Abstraction ■ Handle all external API communication Provide consistent data interfaces Manage caching and state synchronization Handle error scenarios gracefully State Management ■ Use RxJS BehaviorSubject for reactive state Provide observable streams for data updates Implement caching strategies Support real-time data synchronization Error Handling ■ Comprehensive error handling Retry mechanisms User-friendly error messages Logging and monitoring support Template Structure ■ TypeScript Service (service.ts.hbs) ■

```
import { Injectable } from "@angular/core"; import { HttpClient } from
"@angular/common/http"; import { Observable , BehaviorSubject } from "rxjs"; import {
map , catchError } from "rxjs/operators"; export interface ExampleData { id : string ; name :
string ; // Add more properties as needed } @ Injectable ( { providedIn : "root" , } ) export
class ExampleService { private apiUrl = "/api/example" ; // Update with your API endpoint
private dataSubject = new BehaviorSubject < ExampleData [ ] > ( [ ] ) ; public data$ = this .
dataSubject . asObservable ( ) ; constructor ( private http : HttpClient ) { } /** * Get all
example data */ getData ( ) : Observable < ExampleData [ ] > { return this . http . get <
ExampleData [ ] > ( this . apiUrl ) . pipe ( map ( ( data ) => { this . dataSubject . next ( data )
; return data ; } ) , catchError ( ( error ) => { console . error ( "Error fetching example data:" ,
error ) ; throw error ; } ) ) ; } /** * Get example by ID */ getById ( id : string ) : Observable <
ExampleData > { return this . http . get < ExampleData > ( ` ${ this . apiUrl } / ${ id } ` ) .
pipe ( catchError ( ( error ) => { console . error ( ` Error fetching example with ID ${ id } : ` ,
error ) ; throw error ; } ) ) ; } /** * Create new example */ create ( data : Omit <
ExampleData , "id" > ) : Observable < ExampleData > { return this . http . post <
ExampleData > ( this . apiUrl , data ) . pipe ( map ( ( newData ) => { const currentData =
this . dataSubject . value ; this . dataSubject . next ( [ ... currentData , newData ] ) ; return
newData ; } ) , catchError ( ( error ) => { console . error ( "Error creating example:" , error ) ;
throw error ; } ) ) ; } /** * Update existing example */ update ( id : string , data : Partial <
ExampleData > ) : Observable < ExampleData > { return this . http . put < ExampleData > (
` ${ this . apiUrl } / ${ id } ` , data ) . pipe ( map ( ( updatedData ) => { const currentData =
```

```

this . dataSubject . value ; const updatedIndex = currentData . findIndex ( ( item ) => item .
id === id ) ; if ( updatedIndex !== - 1 ) { currentData [ updatedIndex ] = updatedData ; this .
dataSubject . next ( [ ... currentData ] ) ; } return updatedData ; } ) , catchError ( ( error ) =>
{ console . error ( ` Error updating example with ID ${ id } : ` , error ) ; throw error ; } ) ) ; } /**
* Delete example */ delete ( id : string ) : Observable < void > { return this . http . delete <
void > ( ` ${ this . apiUrl } / ${ id } ` ) . pipe ( map ( ( ) => { const currentData = this .
dataSubject . value ; const filteredData = currentData . filter ( ( item ) => item . id !== id ) ;
this . dataSubject . next ( filteredData ) ; } ) , catchError ( ( error ) => { console . error ( `
Error deleting example with ID ${ id } : ` , error ) ; throw error ; } ) ) ; } /** * Get current data
from cache */ getCurrentData ( ) : ExampleData [ ] { return this . dataSubject . value ; } /** *
Clear cached data */ clearCache ( ) : void { this . dataSubject . next ( [ ] ) ; } } Features ■
Built-in Features ■ CRUD Operations Create, Read, Update, Delete operations Type-safe
interfaces Consistent error handling Reactive State Management BehaviorSubject for
current state Observable streams for updates Automatic cache updates Error Handling
Comprehensive error catching Detailed error logging Graceful error propagation Caching
In-memory data caching Cache invalidation strategies Cache clearing methods Type
Safety Strongly typed interfaces Generic type support IntelliSense support Best Practices
■ Service Structure @ Injectable ( { providedIn : "root" , } ) export class ExampleService {
private apiUrl = "/api/example" ; private dataSubject = new BehaviorSubject <
ExampleData [ ] > ( [ ] ) ; public data$ = this . dataSubject . asObservable ( ) ; } Error
Handling getData ( ) : Observable < ExampleData [ ] > { return this . http . get <
ExampleData [ ] > ( this . apiUrl ) . pipe ( map ( data => { this . dataSubject . next ( data ) ;
return data ; } ) , catchError ( error => { console . error ( 'Error fetching data.' , error ) ;
throw error ; } ) ) ; } Cache Management getCurrentData ( ) : ExampleData [ ] { return this .
dataSubject . value ; } clearCache ( ) : void { this . dataSubject . next ( [ ] ) ; } Basic Service
■ # Generate a basic service playplus generate service user This creates: UserService
with CRUD operations UserData interface Comprehensive error handling Caching
mechanisms Advanced Service ■ # Generate with custom interface playplus generate
service product --interface=Product This creates: ProductService with custom interface
Advanced caching strategies Real-time data synchronization Integration with Components
■ Container Components ■ // In container component export class
UserListContainerComponent { private userService = inject ( UserService ) ; protected
users = signal < User [ ] > ( [ ] ) ; constructor ( ) { this . loadUsers ( ) ; } private loadUsers ( )
: void { this . userService . getData ( ) . pipe ( takeUntilDestroyed ( ) ) . subscribe ( { next : (

```

```

users ) => this . users . set ( users ) , error : ( error ) => console . error ( "Failed to load
users:" , error ) , } ) ; } protected createUser ( userData : Omit < User , "id" > ) : void { this .
userService . create ( userData ) . pipe ( takeUntilDestroyed ( ) ) . subscribe ( { next : (
newUser ) => { // User created successfully this . loadUsers ( ) ; // Refresh the list } , error :
( error ) => console . error ( "Failed to create user:" , error ) , } ) ; } } Multiple Services ■ //
In complex container component export class DashboardContainerComponent { private
userService = inject ( UserService ) ; private productService = inject ( ProductService ) ;
private orderService = inject ( OrderService ) ; protected users = signal < User [] > ( [] ) ;
protected products = signal < Product [] > ( [] ) ; protected orders = signal < Order [] > ( []
) ; constructor ( ) { this . loadDashboardData ( ) ; } private loadDashboardData ( ) : void { //
Load all data in parallel combineLatest ( [ this . userService . getData ( ) , this .
productService . getData ( ) , this . orderService . getData ( ) , ] ) . pipe (
takeUntilDestroyed ( ) ) . subscribe ( { next : ( [ users , products , orders ] ) => { this . users
. set ( users ) ; this . products . set ( products ) ; this . orders . set ( orders ) ; } , error : (
error ) => console . error ( "Failed to load dashboard data:" , error ) , } ) ; } } Data Interfaces
■ Basic Interface ■ export interface UserData { id : string ; name : string ; email : string ;
isActive : boolean ; createdAt : Date ; updatedAt : Date ; } Complex Interface ■ export
interface ProductData { id : string ; name : string ; description : string ; price : number ;
category : ProductCategory ; images : string [] ; specifications : Record < string , any > ;
isAvailable : boolean ; stockQuantity : number ; createdAt : Date ; updatedAt : Date ; }
export enum ProductCategory { ELECTRONICS = "electronics" , CLOTHING = "clothing" ,
BOOKS = "books" , HOME = "home" , } Advanced Patterns ■ Caching Strategies ■ export
class AdvancedExampleService { private cache = new Map < string , { data : any ;
timestamp : number } > ( ) ; private readonly CACHE_DURATION = 5 * 60 * 1000 ; // 5
minutes getDataWithCache ( id : string ) : Observable < ExampleData > { const cached =
this . cache . get ( id ) ; const now = Date . now ( ) ; if ( cached && now - cached .
timestamp < this . CACHE_DURATION ) { return of ( cached . data ) ; } return this . http .
get < ExampleData > ( ` ${ this . apiUrl } / ${ id } ` ) . pipe ( map ( ( data ) => { this . cache .
set ( id , { data , timestamp : now } ) ; return data ; } ) ) ; } invalidateCache ( id ? : string ) :
void { if ( id ) { this . cache . delete ( id ) ; } else { this . cache . clear ( ) ; } } } Real-time
Updates ■ export class RealTimeExampleService { private dataSubject = new
BehaviorSubject < ExampleData [] > ( [] ) ; public data$ = this . dataSubject .
asObservable ( ) ; // WebSocket connection for real-time updates private wsConnection :
WebSocket ; constructor ( ) { this . initializeWebSocket ( ) ; } private initializeWebSocket ( )

```

```

: void { this . wsConnection = new WebSocket ( "ws://api.example.com/updates" ) ; this .
wsConnection . onmessage = ( event ) => { const update = JSON . parse ( event . data ) ;
this . handleRealTimeUpdate ( update ) ; } ; } private handleRealTimeUpdate ( update :
any ) : void { const currentData = this . dataSubject . value ; switch ( update . type ) { case
"CREATE" : this . dataSubject . next ( [ ... currentData , update . data ] ) ; break ; case
"UPDATE" : const updatedData = currentData . map ( ( item ) => item . id === update .
data . id ? update . data : item ) ; this . dataSubject . next ( updatedData ) ; break ; case
"DELETE" : const filteredData = currentData . filter ( ( item ) => item . id !== update . data .
id ) ; this . dataSubject . next ( filteredData ) ; break ; } } } Testing ■ Service Testing ■
describe ( "UserService" , ( ) => { let service : UserService ; let httpMock :
HttpTestingController ; beforeEach ( ( ) => { TestBed . configureTestingModule ( { imports :
[ HttpClientTestingModule ] , providers : [ UserService ] , } ) ; service = TestBed . inject (
UserService ) ; httpMock = TestBed . inject ( HttpTestingController ) ; } ) ; afterEach ( ( ) =>
{ httpMock . verify ( ) ; } ) ; it ( "should fetch users successfully" , ( ) => { const mockUsers :
UserData [ ] = [ { id : "1" , name : "John Doe" , email : "john@example.com" , isActive : true
, createdAt : new Date ( ) , updatedAt : new Date ( ) , } , ] ; service . getData ( ) . subscribe (
( users ) => { expect ( users ) . toEqual ( mockUsers ) ; } ) ; const req = httpMock .
expectOne ( "/api/user" ) ; expect ( req . request . method ) . toBe ( "GET" ) ; req . flush (
mockUsers ) ; } ) ; it ( "should handle errors gracefully" , ( ) => { service . getData ( ) .
subscribe ( { next : ( ) => fail ( "Should not succeed" ) , error : ( error ) => { expect ( error .
status ) . toBe ( 500 ) ; } , } ) ; const req = httpMock . expectOne ( "/api/user" ) ; req . flush (
"Server error" , { status : 500 , statusText : "Internal Server Error" , } ) ; } ) ; } ) ; Error
Handling Strategies ■ Retry Logic ■ import { retry , delay } from 'rxjs/operators' ;
getDataWithRetry ( ) : Observable < ExampleData [ ] > { return this . http . get <
ExampleData [ ] > ( this . apiUrl ) . pipe ( retry ( 3 ) , // Retry 3 times delay ( 1000 ) , // Wait
1 second between retries catchError ( error => { console . error ( 'Failed after retries:' ,
error ) ; throw error ; } ) ) ; } Error Transformation ■ import { throwError } from 'rxjs' ; private
handleError ( error : any ) : Observable < never > { let errorMessage = 'An unknown error
occurred' ; if ( error . status === 404 ) { errorMessage = 'Resource not found' ; } else if (
error . status === 500 ) { errorMessage = 'Server error occurred' ; } else if ( error . status
=== 0 ) { errorMessage = 'Network error - please check your connection' ; } console . error
( 'Service error:' , error ) ; return throwError ( ( ) => new Error ( errorMessage ) ) ; }
Performance Optimization ■ Lazy Loading ■ export class LazyExampleService { private
dataSubject = new BehaviorSubject < ExampleData [ ] > ( [ ] ) ; public data$ = this .

```

```
dataSubject . asObservable ( ) ; private loaded = false ; getData ( ) : Observable <
ExampleData [ ] > { if ( ! this . loaded ) { this . loadData ( ) ; } return this . data$ ; } private
loadData ( ) : void { this . loaded = true ; this . http . get < ExampleData [ ] > ( this . apiUrl ) .
pipe ( map ( ( data ) => { this . dataSubject . next ( data ) ; return data ; } ) , catchError ( (
error ) => { this . loaded = false ; // Allow retry throw error ; } ) ) . subscribe ( ) ; } } Next
```

Steps ■ After creating a service: Define the data interface for your specific domain

Implement CRUD operations for your API endpoints Add error handling specific to your

use case Implement caching strategies if needed Write comprehensive tests for all

operations Integrate with container components for data flow Developer Checklist ■

Before Creating Services: ■ Are data interfaces defined for all entities? Is HTTP error

handling implemented with meaningful messages? Is BehaviorSubject used for reactive

state management? Are CRUD operations implemented for all entities? Is retry logic

added for network failures? Are caching strategies implemented where needed? Are all

API endpoints typed with TypeScript? Is data validation and sanitization implemented? Do

I have unit tests with HTTP mocking? Is logging added for debugging and monitoring? Are

RxJS operators used for async operations? Are cache invalidation strategies

implemented?

```
import { Injectable } from "@angular/core";
import { HttpClient } from "@angular/common/http";
import { Observable, BehaviorSubject } from "rxjs";
import { map, catchError } from "rxjs/operators";

export interface ExampleData {
  id: string;
  name: string;
  // Add more properties as needed
}

@Injectable({
  providedIn: "root",
})
export class ExampleService {
  private apiUrl = "/api/example"; // Update with your API endpoint
  private dataSubject = new BehaviorSubject<ExampleData[]>([]);
  public data$ = this.dataSubject.asObservable();

  constructor(private http: HttpClient) {}

  /**
   * Get all example data
   */
  getData(): Observable<ExampleData[]> {
    return this.http.get<ExampleData[]>(this.apiUrl).pipe(
```

```

        map((data) => {
            this.dataSubject.next(data);
            return data;
        }),
        catchError((error) => {
            console.error("Error fetching example data:", error);
            throw error;
        })
    );
}

/**
 * Get example by ID
 */
getById(id: string): Observable<ExampleData> {
    return this.http.get<ExampleData>(`${this.apiUrl}/${id}`).pipe(
        catchError((error) => {
            console.error(`Error fetching example with ID ${id}:`, error);
            throw error;
        })
    );
}

/**
 * Create new example
 */
create(data: Omit<ExampleData, "id">): Observable<ExampleData> {
    return this.http.post<ExampleData>(this.apiUrl, data).pipe(
        map((newData) => {
            const currentData = this.dataSubject.value;
            this.dataSubject.next([...currentData, newData]);
            return newData;
        }),
        catchError((error) => {
            console.error("Error creating example:", error);
            throw error;
        })
    );
}

/**
 * Update existing example
 */
update(id: string, data: Partial<ExampleData>): Observable<ExampleData> {
    return this.http.put<ExampleData>(`${this.apiUrl}/${id}`, data).pipe(
        map((updatedData) => {
            const currentData = this.dataSubject.value;
            const updatedIndex = currentData.findIndex((item) => item.id === id);
            if (updatedIndex !== -1) {
                currentData[updatedIndex] = updatedData;
                this.dataSubject.next([...currentData]);
            }
        })
    );
}

```

```

        return updatedData;
    }},
    catchError((error) => {
        console.error(`Error updating example with ID ${id}:`, error);
        throw error;
    })
);
}

/**
 * Delete example
 */
delete(id: string): Observable<void> {
    return this.http.delete<void>(`${this.apiUrl}/${id}`).pipe(
        map(() => {
            const currentData = this.dataSubject.value;
            const filteredData = currentData.filter((item) => item.id !== id);
            this.dataSubject.next(filteredData);
        }),
        catchError((error) => {
            console.error(`Error deleting example with ID ${id}:`, error);
            throw error;
        })
    );
}

/**
 * Get current data from cache
 */
getCurrentData(): ExampleData[] {
    return this.dataSubject.value;
}

/**
 * Clear cached data
 */
clearCache(): void {
    this.dataSubject.next([]);
}
}

---

@Injectable({
    providedIn: "root",
})
export class ExampleService {
    private apiUrl = "/api/example";
    private dataSubject = new BehaviorSubject<ExampleData[]>([]);
    public data$ = this.dataSubject.asObservable();
}

```

```
getData(): Observable<ExampleData[]> {  
  return this.http.get<ExampleData[]>(this.apiUrl).pipe(  
    map(data => {  
      this.dataSubject.next(data);  
      return data;  
    } ),  
    catchError(error => {  
      console.error('Error fetching data:', error);  
      throw error;  
    })  
  );  
}
```

```
getCurrentData(): ExampleData[] {  
  return this.dataSubject.value;  
}  
  
clearCache(): void {  
  this.dataSubject.next([]);  
}
```

```
# Generate a basic service  
playplus generate service user
```

```
# Generate with custom interface  
playplus generate service product --interface=Product
```

```
// In container component  
export class UserListContainerComponent {  
  private userService = inject(UserService);  
  
  protected users = signal<User[]>([]);  
  
  constructor() {  
    this.loadUsers();  
  }  
  
  private loadUsers(): void {
```



```

    this.userService
      .getData()
      .pipe(takeUntilDestroyed())
      .subscribe({
        next: (users) => this.users.set(users),
        error: (error) => console.error("Failed to load users:", error),
      });
  }

  protected createUser(userData: Omit<User, "id">): void {
    this.userService
      .create(userData)
      .pipe(takeUntilDestroyed())
      .subscribe({
        next: (newUser) => {
          // User created successfully
          this.loadUsers(); // Refresh the list
        },
        error: (error) => console.error("Failed to create user:", error),
      });
  }
}

```

```

// In complex container component
export class DashboardContainerComponent {
  private userService = inject(UserService);
  private productService = inject(ProductService);
  private orderService = inject(OrderService);

  protected users = signal<User[]>([]);
  protected products = signal<Product[]>([]);
  protected orders = signal<Order[]>([]);

  constructor() {
    this.loadDashboardData();
  }

  private loadDashboardData(): void {
    // Load all data in parallel
    combineLatest([
      this.userService.getData(),
      this.productService.getData(),
      this.orderService.getData(),
    ])
      .pipe(takeUntilDestroyed())
      .subscribe({
        next: ([users, products, orders]) => {
          this.users.set(users);
          this.products.set(products);
        }
      });
  }
}

```

```

        this.orders.set(orders);
    },
    error: (error) =>
        console.error("Failed to load dashboard data:", error),
    });
}
}

```

```

export interface UserData {
    id: string;
    name: string;
    email: string;
    isActive: boolean;
    createdAt: Date;
    updatedAt: Date;
}

```

```

export interface ProductData {
    id: string;
    name: string;
    description: string;
    price: number;
    category: ProductCategory;
    images: string[];
    specifications: Record<string, any>;
    isAvailable: boolean;
    stockQuantity: number;
    createdAt: Date;
    updatedAt: Date;
}

```

```

export enum ProductCategory {
    ELECTRONICS = "electronics",
    CLOTHING = "clothing",
    BOOKS = "books",
    HOME = "home",
}

```

```

export class AdvancedExampleService {
    private cache = new Map<string, { data: any; timestamp: number }>();
    private readonly CACHE_DURATION = 5 * 60 * 1000; // 5 minutes

    getDataWithCache(id: string): Observable<ExampleData> {

```

```

const cached = this.cache.get(id);
const now = Date.now();

if (cached && now - cached.timestamp < this.CACHE_DURATION) {
  return of(cached.data);
}

return this.http.get<ExampleData>(`${this.apiUrl}/${id}`).pipe(
  map((data) => {
    this.cache.set(id, { data, timestamp: now });
    return data;
  })
);
}

invalidateCache(id?: string): void {
  if (id) {
    this.cache.delete(id);
  } else {
    this.cache.clear();
  }
}
}

---

export class RealTimeExampleService {
  private dataSubject = new BehaviorSubject<ExampleData[]>([]);
  public data$ = this.dataSubject.asObservable();

  // WebSocket connection for real-time updates
  private wsConnection: WebSocket;

  constructor() {
    this.initializeWebSocket();
  }

  private initializeWebSocket(): void {
    this.wsConnection = new WebSocket("ws://api.example.com/updates");

    this.wsConnection.onmessage = (event) => {
      const update = JSON.parse(event.data);
      this.handleRealTimeUpdate(update);
    };
  }

  private handleRealTimeUpdate(update: any): void {
    const currentData = this.dataSubject.value;

    switch (update.type) {
      case "CREATE":

```

```

        this.dataSubject.next([...currentData, update.data]);
        break;
    case "UPDATE":
        const updatedData = currentData.map((item) =>
            item.id === update.data.id ? update.data : item
        );
        this.dataSubject.next(updatedData);
        break;
    case "DELETE":
        const filteredData = currentData.filter(
            (item) => item.id !== update.data.id
        );
        this.dataSubject.next(filteredData);
        break;
    }
}
}

```

```

describe("UserService", () => {
    let service: UserService;
    let httpMock: HttpTestingController;

    beforeEach(() => {
        TestBed.configureTestingModule({
            imports: [HttpClientTestingModule],
            providers: [UserService],
        });

        service = TestBed.inject(UserService);
        httpMock = TestBed.inject(HttpTestingController);
    });

    afterEach(() => {
        httpMock.verify();
    });

    it("should fetch users successfully", () => {
        const mockUsers: UserData[] = [
            {
                id: "1",
                name: "John Doe",
                email: "john@example.com",
                isActive: true,
                createdAt: new Date(),
                updatedAt: new Date(),
            },
        ],
    ];

    service.getData().subscribe((users) => {

```

```

        expect(users).toEqual(mockUsers);
    });

    const req = httpMock.expectOne("/api/user");
    expect(req.request.method).toBe("GET");
    req.flush(mockUsers);
});

it("should handle errors gracefully", () => {
    service.getData().subscribe({
        next: () => fail("Should not succeed"),
        error: (error) => {
            expect(error.status).toBe(500);
        },
    });
});

const req = httpMock.expectOne("/api/user");
req.flush("Server error", {
    status: 500,
    statusText: "Internal Server Error",
});
});
});

---

import { retry, delay } from 'rxjs/operators';

getDataWithRetry(): Observable<ExampleData[]> {
    return this.http.get<ExampleData[]>(this.apiUrl).pipe(
        retry(3), // Retry 3 times
        delay(1000), // Wait 1 second between retries
        catchError(error => {
            console.error('Failed after retries:', error);
            throw error;
        })
    );
}

---

import { throwError } from 'rxjs';

private handleError(error: any): Observable<never> {
    let errorMessage = 'An unknown error occurred';

    if (error.status === 404) {
        errorMessage = 'Resource not found';
    } else if (error.status === 500) {
        errorMessage = 'Server error occurred';
    }
}

```

```

    } else if (error.status === 0) {
      errorMessage = 'Network error - please check your connection';
    }

    console.error('Service error:', error);
    return throwError(() => new Error(errorMessage));
  }
}

```

```

export class LazyExampleService {
  private dataSubject = new BehaviorSubject<ExampleData[]>([]);
  public data$ = this.dataSubject.asObservable();
  private loaded = false;

  getData(): Observable<ExampleData[]> {
    if (!this.loaded) {
      this.loadData();
    }
    return this.data$;
  }

  private loadData(): void {
    this.loaded = true;
    this.http
      .get<ExampleData[]>(this.apiUrl)
      .pipe(
        map((data) => {
          this.dataSubject.next(data);
          return data;
        }),
        catchError((error) => {
          this.loaded = false; // Allow retry
          throw error;
        })
      )
      .subscribe();
  }
}

```